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Overview of Anti-Terrorism Related Research Ongoing at the TNO Defence Research Organisation

J.C.A.M. van Doormaal (M.Sc.) and Dr. L.H.J. Absil
TNO Prins Maurits Laboratory
Research Group Explosion Prevention and Protection
Lange Kleiweg 137
2280 AA Rijswijk
THE NETHERLANDS
0031-152843392 /0031152843954 0031-152843395 /0031152843954

Doormaal@pml.tno.nl / Absil@pml.tno.nl

Since the 11 September 2001 attacks in the United States, also in The Netherlands the terrorist threat has become a serious concern. There is an increasing concern about the security of the public and vulnerability of vital components of national infrastructure. Since then, a number of from terrorist activities suspected persons have been arrested in the Netherlands and a number of concrete threats on tunnels, railway-stations and public buildings have occurred. Consequently, on behalf of various governmental organisations the Anti-Terrorism research effort at the TNO Defence Research Organisation has increased considerably over the last few years.

This research has been focused on issues like:

- Determining the threat of terrorist attacks facing the Netherlands and what types of weaponry (B-, C-weapons and conventional explosives), may be used in different scenarios.
- Detection of High Explosives.
- An assessment of the vulnerability of vital infrastructure, such as energy facilities, telecommunications, water supply, and public buildings, through a quick scan.
- Possibilities for protection against CBRN-threats.
- For some selected infrastructure an assessment was made of the blast vulnerability. Therefore specific scenarios were drafted (e.g. a large car bomb explosion at some distance in an urban area) and the blast vulnerability and consequence for buildings was assessed. In case needed, advice was given on protection measures, in terms of the use of blast resistant windows and structural retrofitting. This work was done using methodologies like:
  - Described in Technical Manual 5-1300 “Fundamentals of protective design for conventional weapons”;
  - Experimental data (e.g. on windows) as obtained in TNOs blast simulators;
  - Numerical simulation of blast propagation and diffraction using TNOs BLAST-3D code; and
  - Structural response analysis using hydro-codes or TNOs toolbox approach.
- A small protection blast container of 60 cm cross section was developed that is capable of capturing the fragments of small high explosives items (up to 1 kg HE charges) and redirect the blast away from people and vital infrastructure. This protection device can be used to reduce the threat of suspected packages at airports, railways or found in public buildings.

Paper presented at the RTO SCI Symposium on “Systems, Concepts and Integration (SCI) Methods and Technologies for Defence Against Terrorism,” held in London, United Kingdom, 25-27 October 2004, and published in RTO-MP-SCI-158.

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- Much is known about the effectiveness of blast barriers, which may be used as a preventive measure.

In the paper an overview of the research ongoing at TNO Defence Research, a number of specific cases and concrete findings will be reported.

Overview of Anti-terrorism related research ongoing at the TNO Defence Research Organisation

TNO Prins Maurits Laboratory

Ans van Doormaal

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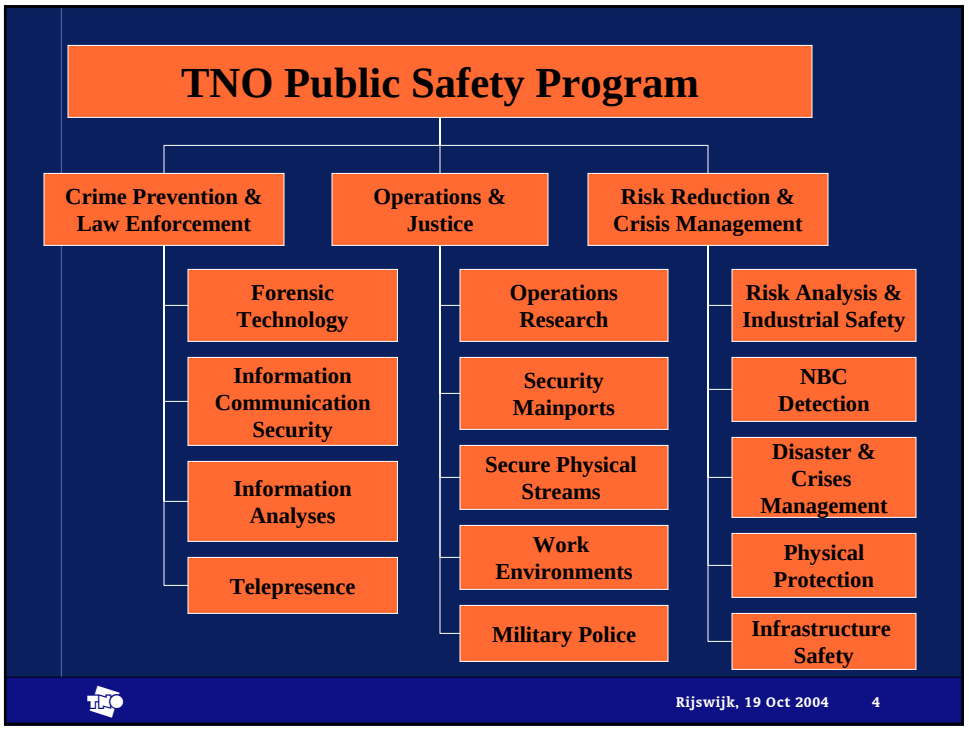
Contents

- **Introduction**
  - NL perspective of threat
  - TNO Public Safety
  - Vital infrastructure NL
- **Anti-terrorism research at TNO**
  - CBRN and conventional weapons
    - Evaluation of threat
    - Prevention and protection
    - Vulnerability studies

Introduction

- **Concern about terrorism in NL**
  - WTC attack 2001
  - Threat alerts in NL
    - tunnels, rail-way-stations and public buildings
    - powder letters
  - Arrest of terrorists
  - Other signals of terrorist activities against NL.
- **Approach in NL:**
  - Policy determined by Ministry of Internal Affairs with support of other Ministries and Social Partners
  - Action plan: 46 Actions (eg. intelligence, security, emergency response)
  - Protection Vital infrastructure
- **TNO:**
  - Mission: to enable scientific knowledge to strengthen the capacity of businesses and government to innovate
  - Business unit **Public Safety**



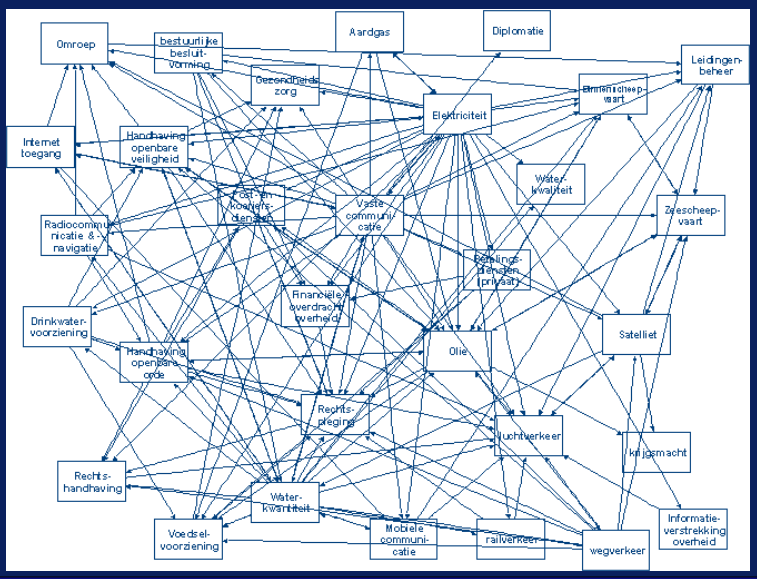
Protection Vital Infrastructure

- **Quick scan study (2002-2003):**
  - Inventory of
    - Vital infrastructure NL
    - Links and junctions in vital infrastructure
  - Vital product or service:
    - Essential contribution to daily life (public safety, economy, health, environment, legal order)
    - Loss results in damage at national level
  - Coordination by TNO
  - Contribution of government, authorities and business
- **Inventory of protective measures (current phase):**
  - Balanced and coherent set of protective measures
    - Vulnerability of vital infrastructure
    - Overview of possibilities, necessity and priority
- **Implementation of measures**

11 Vital sectors, 31 products

- **Energy (electricity, oil, gas)**
- **Telecommunication (satellites, telecommunication, radio-communication and navigation, network, internet, mail)**
- **Food (supply)**
- **Transport (road, railway, inland and ocean shipping, air)**
- **Drinking water (supply)**
- **Surface water (quality, quantity)**
- **Government (diplomacy, information, armed forces, management)**
- **Public order and safety (enforcement)**
- **Health (health care)**
- **Finances (payments, governmental financial infrastructure)**
- **Legal order (assertion)**

Links and junctions



Findings quick scan

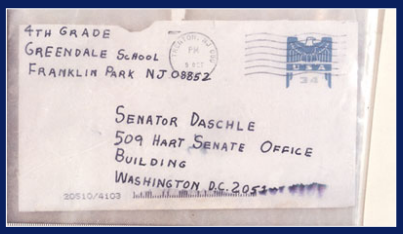
- **Infrastructure is complex and interwoven**
- **Top sectors:**
  - Electricity
  - Quantity of surface water
  - Transport
  - Telecommunication
- **Chain reaction possible**
- **International links**

- **Next: vulnerability and possible measures**

Related TNO research

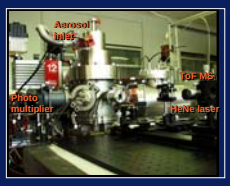
- Detection of and protection against CBRN agents
- Detection of explosive devices
- Protection against explosions

CBRN-agents



Specific TNO expertise and experience in detection of CBRN-agents

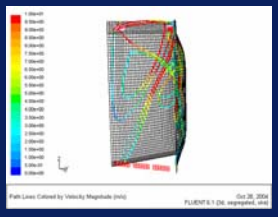
- **Research group Detection & Identification and Analytical Chemistry**
- **Special expertise and facilities**
  - Knowledge on CBRN-agents
  - Analytical and synthetic technologies (eg. chromatography, spectrometry)
  - Detector testing (eg. sensitivity, response rate)
  - Operational detection tools (real time and in small apparatus)
  - High Tox Laboratory



- **Design or development of detection methods**
- **Evaluation of detection tools (NATO triptych)**
- **24 hour Emergency Response Team**

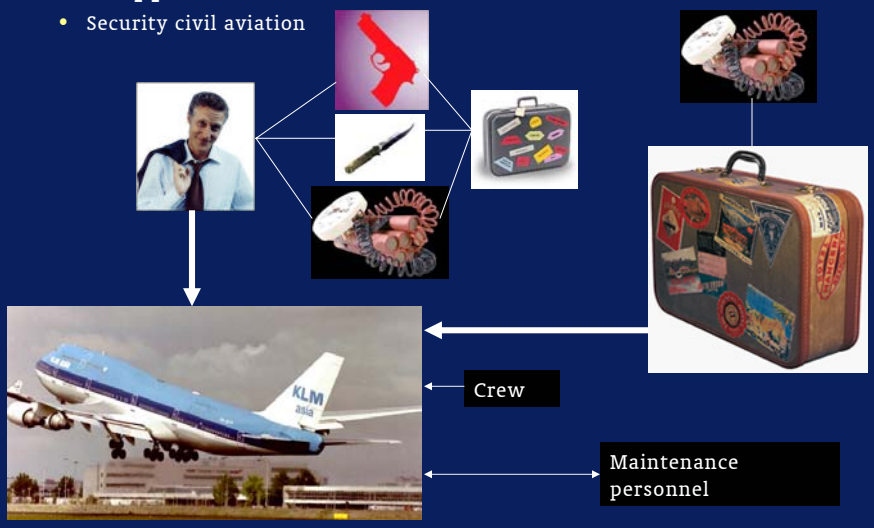
Specific TNO expertise and experience in protection against CBRN-agents

- **Research division Chemical and Biological Protection**
- **Special expertise and facilities**
  - Knowledge on CBRN-agents
  - Toxicokinetic and physiologically-based modelling
  - Determination of Physico-chemical properties of chemical substances
  - Models for human diseases and injuries
  - Models for penetration
  - Test chamber and mannequin for clothing tests
  - Test system for gas masks
- **Certification**



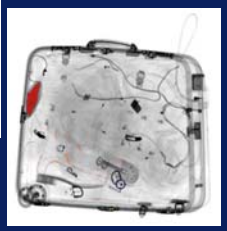
Detection of explosives

- **Main application:**
  - Security civil aviation



Specific TNO expertise and experience in explosives detection

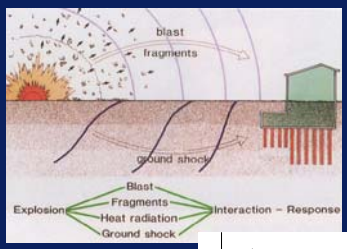
- **Research group Properties of Energetic Materials**
- **Since 1994**
- **Expertise**
  - in explosives
    - Knowledge
    - Stock
    - Use and handling
    - Analysis
  - & experience in testing
    - With live explosives
    - Assessment of performance
    - Evaluation against standards
    - Development of reliable and balanced tests
- **Development of detection methods and integrated technologies**
  - X-ray, Infrared

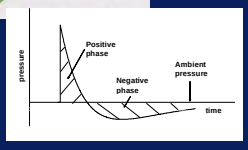


Bomb attacks

Specific TNO expertise and experience in explosions and protection

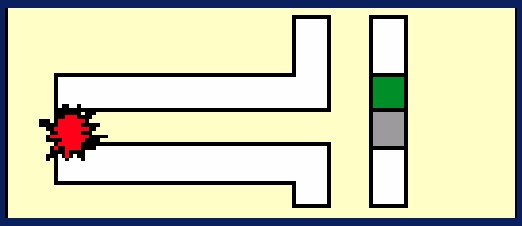
- **Research group Explosion Prevention and Protection**
- **Expertise**
  - In explosions
    - Knowledge of blast propagation
    - Quantification of effects
  - Structural response
    - Knowledge of dynamic behaviour
    - Knowledge of damage levels
    - Prediction tools
  - Testing
    - Full scale field test
    - Small scale model tests
    - Blast simulator tests
    - Measuring explosion effects and structural results
- **Development of protective structures**





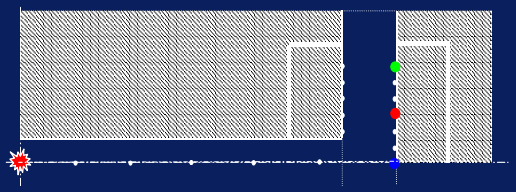
Example: vulnerability study

- In urban area
  - Influences propagation of blast
- Target or close to possible target
- Large car bomb
- Questions:
  - Possible damage
  - Danger for people
  - Possibilities to take measures

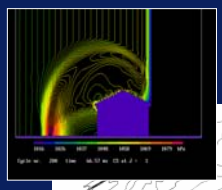


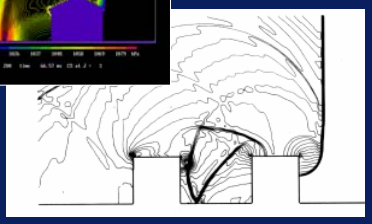
Prediction blast loading

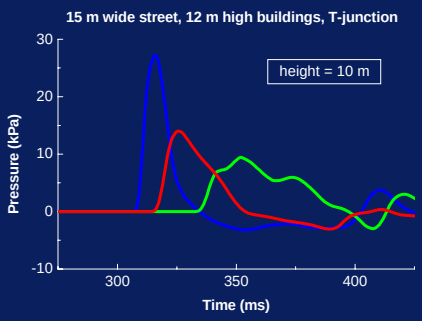
- 1000 kg at 150 m
- Influence of shielding



- Computertool: Blast3D

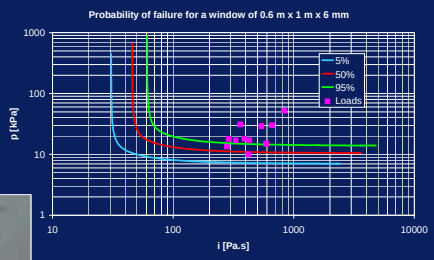






Consequences

- Damage level: light
- Most dangerous for occupants: window failure
  - Calculate probability of window failure (TNO-model)
  - Probability of lethality (TNO risk analysis model)



Advise for retrofit measures

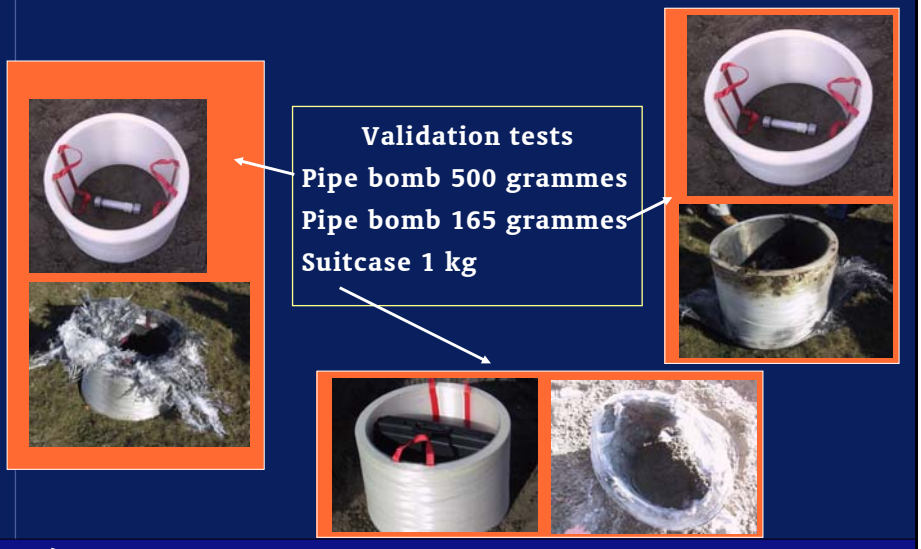
- Safety film
- Catch system
- Blast resistant windows

- Testing

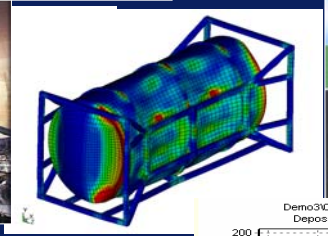
Example of product development
TNO-product: Episafe Protective Explosion Container

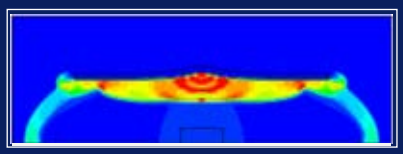
- Quick protection for small explosive devices

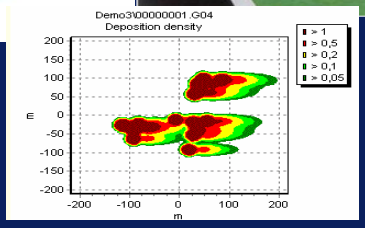
Episafe Protective Explosion Container



Other







Thank you for your attention!

Questions?

www.tno.nl
www.pml.tno.nl
doormaal@pml.tno.nl
absil@pml.tno.nl